ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)

Vol 11, Issue 6, June 2024

Mobile Apps-Enhanced Strategic Intervention Materials (MAeSIM) In Junior High School Physics

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Abstract*— This descriptive study developed a Mobile Apps-enhanced Strategic Intervention Material (MAeSIM) in Junior High School Physics using the Research and Development (R and D) methodology. Prior to the development of the material, a least mastered competencies in JHS Physics survey was administered. The MAeSIM was developed following the Input-Process-Output (IPO) model, anchoring on m-learning and e-learning theories. Validators were purposively chosen to assess the quality of the material in terms of content, technical and level of acceptability using checklists and rating scales via offline and online modes. Mean and frequency counts were used for the analysis and description of the validity and acceptability of the MAeSIM. Results of the validation revealed that the MAeSIM is valid in terms of content and technical quality and is highly acceptable in terms of content and design characteristics. The MAeSIM provides substantial, interactive, and engaging Physics- learning experiences to learners by tapping their innate inclination and interest to mobile games and ICT-based activities. The MAeSIM features adhere to the m-learning and e-learning principles namely Learner Control Principle and Multimedia Learning Principle. These emphasize that a learner's learning is more effective with the use of multimedia and ICT tools because these could stimulate more senses and keep them highly engaged and they are given control over their pacing and learning environment. It is recommended that teachers should utilize the MAeSIM in instruction to teach and reteach the least mastered competencies of learners in Physics and enhance their level of interest and engagement to learn Physics.

Keywords: Mobile-apps, Strategic Intervention Materials, Junior High School, Physics Education

I. INTRODUCTION

Science and technology are essential drivers towards development in many aspects. Technological and scientific revolutions reinforce economic advances, improvements in health systems, education and infrastructure [24]. Also, Science and Technology as one that is critical to any nation's current and future development, and technology is achieved through a combination of knowledge, methods, tools and skills [9] Science has been playing a major role in modernization and improvement of the quality of life. This claim is apparent with the continuous researches for innovations and inventions. In addition, Science has been recognized as an effective means of reinforcing man's competitive edge for national development and progress as stated in the 1987 Philippines Constitution, Article XIV, Section 10.

However, in the field of education, the findings of recent international student examinations, such as in the Programme for International Student Assessment (PISA), showed Philippines to be at the least in the area of Reading Comprehension, Science and Mathematics [70]. In the 2018 National Achievement Test (NAT) report by the Department of Education (DepEd), it was stated that the results of the NAT for Grade 10 are indicative of the very low performance of students in science and mathematics specifically in the aspect of problem-solving and critical thinking skills. Moreover, numerous educators and graduate student researchers have discovered several variables that contribute to Filipino students' poor performance and lack of enthusiasm in science. These variables are: school resources and availability of apparatus and equipment, unsafe and discouraging learning environment, the pandemic, and unmeaningful teaching strategies and learning materials [73].

Likewise, [13] stated that the problem of learners' low performance is evident in the current Science education specifically in the field of Physics. Compared to other Science subjects, Physics is considered by most students to be the most difficult and complex area. It also gains the least number of engagement and appreciation from students. Physics' reputation as a tough topic among students may be one cause for students' waning interest in the subject during their secondary education. [92] also said that students have difficulty in comprehending abstract concepts in Physics because of the usual teaching practices which commonly consist of lectures, low inquiry-based activities and standard examinations of concepts leading to lower-order cognitive skills.

The findings above are observable in most Junior High School (Grades 7 to 10) learners. In this level, learners take Science subjects in spiral progression wherein the level of content knowledge that the learners should acquire increases and becomes more complex as they go through the grade levels. This makes students perceive that learning Physics is nonconcrete and difficult. In addition, empirical survey conducted by [7] revealed some student-related challenges today in Physics teaching. These are adjusting to the new online learning environment, ability to psychologically maintain focus in the virtual learning environment and new assessment formats. Some teachers employed virtual laboratories and simulations to carry out

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)

Vol 11, Issue 6, June 2024

difficult-to-complete laboratory experiments due to their nature and the hazards involved [18]. These problems may result to least-mastered competencies in the subject by the students.

In the K to 12 curriculum, one of the foci is to promote the utilization of technology to enhance the students' academic performance in a more engaging and efficient way. According to [50], combining the use of ICT in education with the project method could be a promising tool for modernizing Physics instruction and making natural sciences more appealing through engaging multimedia, internet communication, and now even mobile games. The development of ICT provided various changes in schools especially in the teaching-learning process. Including technologies such as smartphones, laptop, and personal digital assistant, which are applications, can improve the learning and teaching process [90].

With the challenge in education brought about by the New Normal, the use of ICT-based teaching modalities through Blended Learning (BL) instruction is one of the eyed solutions. The use of devices such as laptop computers, radio, and television and even mobile apps coupled with modules and activity guides are the most available means as of now. However, lack of instructional materials, especially in the area of Physics, is still a problem.

In the present educational set up, teachers are in constant search of effective and possible ways to teach their students, and one of which is the use of Electronic Strategic Intervention Material (eSIM). The eSIM is an instructional material usually developed with the use of simulations, videos, presentations and other ICT tools used to deliver or teach competencies or topics which are least mastered by the students. This is a learning material that is used to teach a certain concept or topic with minimal supervision by the teacher, hence, making learning more student-centered. With eSIM, the student could perform activities, discover concepts and evaluate himself. Also, eSIM is receiving a great deal of interest today as regards its potential for teaching and learning as well as its capability to improve the least mastered competencies from the curriculum. According to Antonio, Bayona and Bautista (2017), the use of eSIM in Science helps students master their least-mastered competency specifically in identifying variables. They also added that student-participants highly favored the use of eSIM in learning Science concepts.

Likewise, the use of mobile phones is also eyed to be an effective means of instruction. Learners today are digital citizens, therefore they have high interest into utilizing gadgets, specifically mobile phones and apps in learning. With the use of mobile technologies, the potential for effective teaching and learning is growing [1]. Despite the fact that it is seen as a possible distraction for pupils, particularly in their studies, some secondary school administrators are now seriously considering the possibilities of mobile devices in boosting learning results. Learners' interest towards mobile-apps and the growing use of the eSIM as instructional material are notable. With the stated features of mobile-apps and characteristics of the eSIM, the researcher thought of "what if the two will combine?". In the present literature available, the researcher noted that there is a dearth of research that combines the two in Physics Education. Hence, this study.

In the light of the lag in literature, the concerns stated above and with the current adherence to the Inter Agency Task Force (IATF) protocol for education, the researcher developed Mobile Apps-enhanced Strategic Intervention Materials (MAeSIM) in Physics for JHS to help students cope with the lack of pandemic-response materials in Physics and to provide a set of learning materials that could harness the students' interest in learning the subject, participation in class discussions and improve their academic performance, specifically in Physics.

The study is anchored on Mobile Learning (M-Learning) Theory and E- Learning Theory. The concepts of M-Learning were given by Alan Kay in 1970s. Chronologically, M-learning research has been characterized into three phases: first phase is the focus upon devices; second is the focus on learning outside the classroom; and third phase is the focus on the mobility of the learner. In Mobile Learning Theory (MLT), students learn across both space and time and move from topic to topic. Like a blended environment, learners move in and out of engagement with technology. A key point in mobile learning theory is that it is the learner that is mobile, not the technology [85]. Both the M-Learning and E-Learning did supplement and were utilized for the conceptualization and development of this research.

A. Statement of the Problem

This study aimed to develop Mobile Apps-enhanced Strategic Intervention

Materials (MAeSIM) in Physics for Junior High School (JHS) based on the least mastered competencies.

Specifically, it sought answers to the following questions:

1. What are the least mastered competencies in Physics for JHS as perceived by the teachers?
2. What MAeSIM could be developed on the identified least mastered competencies in Physics?
3. How valid is the MAeSIM in Physics in terms of its:
   3.1 content quality along;
   3.1.1 objectives,
   3.1.2 activities,
   3.1.3 instructional characteristics, and
   3.1.4 assessment techniques ?
   3.2 technical quality along;
   3.2.1 usability,
   3.2.2 efficiency, and
   3.2.3 presentation?
4. What is the level of acceptability of the MAeSIM in terms of its:
   4.1 content along;

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)

Vol 11, Issue 6, June 2024

4.1.1 objectives,
4.1.2 subject matter organization and presentation,
4.1.3 learning activities,
4.1.4 discussion air and guide questions, and
4.1.5 evaluation exercises?
4.2 design along;
4.2.1 design characteristics, and
4.2.2 adaptability?

II. METHODLOGY

The descriptive research design utilizing survey and the Resarch and Development (R&D) methodology was used to develop and validate the Mobile Apps-enhanced Strategic Intervention Materials (MAeSIM). This allowed the researcher to create innovations that could significantly help the teaching and learning process.

The researcher determined through a survey the Physics topics in the Junior High School Science which are least mastered and may need the MAeSIM to be integrated. In the planning, development and validation of the MAeSIM, this study used the Research and Development process.

The study was conducted in the public schools, particularly Junior High Schools, of the two (2) DepEd schools divisions in Ilocos Norte, namely the Schools Divisions of Laoag, which consists of seven (7) public high schools, and Ilocos Norte with fifty-seven (57) public high schools. This study used four (4) research instruments in the conduct of the study – a Least Mastered Competency Survey Checklist, a Technical Quality Validation Checklist, a Content Validation Checklist, and an Acceptability Survey Checklist.

III. RESULTS AND DISCUSSION

Junior High School Physics contains competencies that were perceived by teachers to be least mastered by students. The top three (3) least mastered competencies in Grades 7 and 8 and the top two (2) in Grades 9 and 10, which have related, appropriate and available free mobile applications, were considered in the development of the MAeSIM. The chosen competencies were as follows: for Grade 7, a) Create and interpret visual representation of the motion of objects such as tape charts and motion graphs, b) Relate characteristics of light such as color and intensity to frequency and wavelength, and c) Describe the different types of charging processes; for Grade 8, the competencies are, a) Relate the laws of motion to bodies in a uniform circular motion, b) Infer that circular motion requires the application of constant force directed toward the center, and c) Explain the functions of circuit breakers, fuses, earthing, double insulation, and other safety devices in the home; for Grade 9, the competencies considered are, a) Describe the horizontal and vertical motions of a projectile, and b) Explain how electrical energy is generated, transmitted, and distributed; and, for Grade 10, the competencies included in the MAeSIM are a) Apply ray diagramming techniques in describing the characteristics and positions of images formed by lenses; and b) explain the operation of a simple electric motor and generator.

The MAeSIM in Physics is an interactive module-type and mobile apps-enhanced instructional material that aims to teach or reteach the least-mastered competencies in Junior High School Physics. It contains six main sections, namely Guide card, Activity card, Assessment card, Enrichment card, Answer card, and Reference Card. The MAeSIM was designed in a PowerPoint set-up. It can be used with various devices such as laptops, desktops, and even smartphones. It is also rendered in minimum volume format to run it smoothly with minimum memory, internet, and device specification requirements. It was also designed to be interactive and engaging for the learner using mobile games and simulations like Drag Racing and Hill climb Racing. This gives them fun, interactive, and meaningful experiences for guided and independent learning at their own pace and time.

The MAeSIM was evaluated as valid in terms of its content quality (4.39) which includes its objectives (4.33), content (4.81), activities (4.17), instructional characteristics

(4.27), and assessment techniques (4.01). The evaluators said that the objectives are SMART, and the activities are interactive and engaging. They also stated that the option for the learner to take the assessment, whether online or offline, is a good idea. Also, the technical quality of the MAeSIM, which includes efficiency (4.48), presentation (4.19), and usability (4.59), was rated valid with an overall mean rating of 4.42. This was supported by the feedback of the technical validators when they stated that the MAeSIM is adaptable and can be utilized with minimum system requirements.

However, some aspects were considered to improve its technical quality.

Lastly, the MAeSIM is very highly acceptable in its content (4.57) and design (4.49) as indicated by an overall mean rating of 4.53. The Physics teachers said that the MAeSIM is aligned with the prescribed DepEd curriculum guide in JHS Science. They also believe that MAeSIM could help the learners to be more active in participation, and could develop their sense of involvement since the MAeSIM's activities enhanced with mobile applications are highly likable by the learners because these tap their interest in mobile games and applications as well as their ICT knowledge.

IV. CONCLUSIONS

Taking into consideration the findings, it can be concluded that the Mobile Apps-enhanced Strategic Intervention Materials (MAeSIM) in Junior High School Physics is a valid instructional material as evaluated by different panels of validators.

The MAeSIM is valid in its content and technical quality and is very highly acceptable in terms of its content and design.

The MAeSIM could provide substantial, interactive, and engaging Physics learning experiences to learners by tapping

on their interest in mobile games and their innate inclination to ICT-based learning and activities.

The MAeSIM features adhere to the principles of m-learning and e-learning theories which highlight Learner Control Principle and Multimedia Learning Principle emphasizing that learners' learning is more efficient when they are given control over the pacing and their learning environment, and immersed in multimedia components such as videos, images, and games, with the use of various ICT tools like laptops, computers and smartphones. In addition, the insertion of mobile apps, such as Physics-relevant games and simulations, provides an interactive learning experience which makes learners engaged and confident in learning Physics concepts.

V. RECOMMENDATION

Considering the findings of this study, the researcher highly recommends the use of the MAeSIM by Physics teachers in Junior High School. This is to address the problem on the least mastered competencies of students and help them better learn these competencies in JHS Physics. The MAeSIM is also recommended to be used to teach or reteach Physics concepts which learners poorly master.

To further establish the validity of the MAeSIM, this must be utilized in teaching the least mastered competencies in Physics, and research must be conducted to see its effects on students' overall performance in Physics. By using the material, its content and technical qualities could also be improved.

Physics teachers, together with ICT experts and IM developers, should design and produce more instructional materials that are mobile apps-enhanced and can be used not only as SIMs but also for in-classroom instruction. ICT experts and IM designers should also consider the end-users feedback to improve further the quality of the materials being developed. They should also improve or modify the material's user interface (UI) by adding a locking feature on the menu options to avoid cheating.

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